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FLOOD INSURANCE STUDY

CITY OF MANTI, UTAH

SANPETE COUNTY

AUGUST 4, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER 490118

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
CITY OF MANTI, SANPETE COUNTY, UTAH

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Manti, Sanpete County, Utah and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Rollins, Brown, and Gunnell, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1628. This study was completed in December 1985.

1.3 Coordination

Streams requiring detailed study were identified at an initial coordination meeting attended by representatives of the City of Manti, FEMA, and the study contractor in April 1984.

Requests for pertinent information were made to the City of Manti, U.S. Forest Service (USFS), U.S. Army Corps of Engineers (COE), U.S. Soil Conservation Service (SCS), U.S. Geological Survey (USGS), Utah Division of Water Resources, and Utah Water Research Laboratory.

Results of the hydrologic analyses were sent to the city, the State Division of Comprehensive Emergency Management, the Manti-LaSal National Forest, and the COE for review and comment. An intermediate coordination meeting was held on February 22, 1986

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with Manti officials to review preliminary delineations of the flood boundaries. The city officials indicated that the map appeared to adequately depict flood hazards and no revisions were recommended at this meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Manti, Sanpete County, Utah. The area of study is shown on the Vicinity Map (Figure 1).

The flooding sources of Manti Creek, and the north and south branches of Manti Creek (City Creek and South Creek, respectively) were studied by detailed methods.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through December 1990.

2.2 Community Description

The City of Manti is located in western Sanpete County, in central Utah. The city is situated on the eastern edge of the Sanpete Valley at the mouth of Manti Canyon and is surrounded by unincorporated areas of Sanpete County. Nearby communities include the City of Ephraim to the north and the Town of Sterling to the south.

The economy of the area is based mainly on agriculture and livestock production. Development in and near the floodplain is largely residential with some commercial development located along Main Street. The population of Manti in 1980 was approximately 2,080 (Reference 1).

Vegetation in the area varies with elevation and slope. Aspen and conifer forests exist generally in the high elevations with pinyon-juniper, oakbrush, sagebrush, and shadscale-greasewood in the middle and lower watershed areas. Desert grasses and sagebrush are the natural vegetation for the outwash fan upon which the City of Manti is built.

Just below the mouth of Manti Canyon, the Manti Creek channel splits into two branches and runs westerly through the city. The north branch is known as City Creek and is apparently the natural channel of the stream. The south branch is known as the flood channel, or South Creek, and was constructed to convey flood waters through the city.

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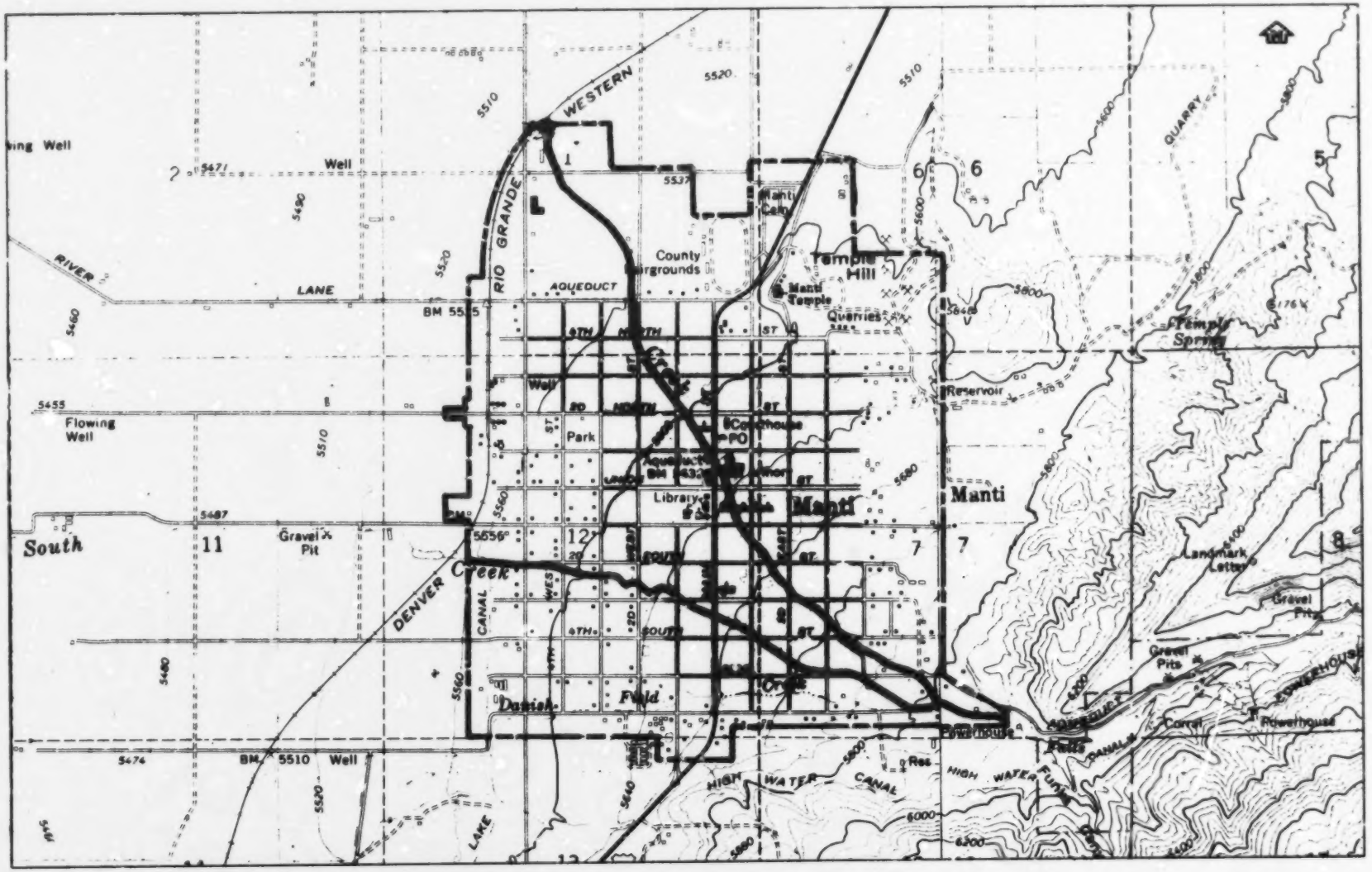

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MANTI, UT
(SANPETE CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

FIGURE 1

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2.3 Principal Flood Problems

Precipitation in the Manti area originates from two major sources. Moisture laden polar Pacific air entering the area from the west or northwest during the winter produces large general storms, which most often result in heavy snowfall in the upper elevations and either snowfall or moderate intensity rainfall in the lower elevations.

The second major source of precipitation in the area arises from topical air masses entering from the south and southwest out of the Gulf of Mexico during the summer. These air masses cause high intensity convective cloudburst storms, which are augmented by the orthographic lifting that occurs as the air masses pass over the mountains immediately east of Manti.

Flooding in the Manti area can result from either heavy spring snowmelt or from summer cloudburst storms. The most significant and damaging floods have usually been the result of cloudburst storms; however, significant damages and problems were caused by the 1983 and 1984 snowmelt runoff floods. The dates and discharge of floods available on Manti Creek are given in Table 1.

TABLE 1. MAJOR FLOODS AFFECTING MANTI, UTAH

Date	Peak Flow (cubic feet per second)
July 30, 1852	--[1]
August 16, 1889	--[1]
July 18, 1890	--[1]
August 13, 1891	--[1]
July 11, 1899	--[1]
August 1, 1901	--[1]
July 29, 1936	--[1]
May 1952	800
August 25, 1955	1000[1]
August 12, 1964	--[1]
May 1983	500
May 1984	674

[1] Peak flow data not available

2.4 Flood Protection Measures

In 1903, two large dams of boulders were built on Manti Creek just inside the mouth of the canyon. These served to catch logs and debris which came down with the floods. The two dams have been sporadically cleaned and modified since then. In the spring of 1979, the upper dam washed out due to deterioration of the log

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cribbing used to reinforce the rockfill. This dam has been rebuilt and has a large boulder lined spillway. Both dams are now full of sediment and have no flood storage volume below the spillway levels. They do, however, serve to slow floodwaters enough to remove some logs and debris.

The control structure at the junction of Manti Creek, City Creek, and South Creek was damaged by the 1983 and 1984 floods and has been rebuilt. The new structure is designed to limit the flow in City Creek to less than 200 cubic feet per second (cfs), which is the capacity of the channel. This channel, which is an irrigation canal, runs northwest through the city, has numerous bridge crossings, and has been lined with grouted rock along much of its length.

South Creek was originally constructed to carry flood waters through the city. This channel has numerous bridge crossings, many of which were too small for the 1983 and 1984 floods and had to be removed to prevent flooding. The City of Manti is currently in the process of replacing the bridges on South Creek with 8 x 10-foot box culverts; however, only the bridges below Main Street are complete. The replacements of the Main Street bridge and those above it have not yet been scheduled. This older segment of the flood channel is generally semicircular in cross section, 8 feet in diameter, and lined with grouted rock. The improved channel segment west of Main Street has been lined with gabions and riprap at most places in order to reduce erosion of the streambanks.

Nonstructural flood control measures include protection of the watershed from fire and overgrazing. This is currently being administered by the U.S. Forest Service.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1 and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is

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approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Gage records for Manti Creek are available at a site approximately 2.5 miles upstream from Manti for the periods 1965 to 1974 and 1979 to 1984 for a total of 16 years of record. Flood flow-frequency analysis of the streamflow records were conducted in accordance with the U.S. Water Resources Council Bulletin 17B (Reference 2). The log-Pearson Type III probability distribution was assumed with a regional skew of -0.2 used in the calculations of the 10- and 50-year floods.

The 16 years of record for Manti Creek was felt to be too short for reliable estimates of the 100- and 500-year floods, therefore, the frequency estimates were weighted with flood frequency estimates obtained using the most recent USGS regional method (Reference 3). The weighted frequency curve for the stream gage was transferred downstream to obtain the flood frequencies at the canyon mouth.

The new diversion structure at the division of City and South Creek limits the flow in City Creek to less than the channel capacity of 200 cfs. Flooding does not occur along this channel. If the gate on City Creek is closed, or the channel plugged, the entire flow could go down South Creek.

Peak discharge-drainage area relationships for Manti Creek and South Creek are shown in Table 2.

TABLE 2. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Manti Creek					
At Canyon Mouth	32.3	660	840	970	1380
At Stream Gage (Approximately 2.5 miles upstream of Manti)	26.4	570	730	840	1200
South Creek					
Downstream of Manti Creek	32.3	660	840	970	1380

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of South Creek and City Creek at bridges, along with bridge geometry, were obtained by field surveys. Extensions of these cross sections and other cross sections were obtained from topographic maps at a scale of 1:4800 with a contour interval of 4 feet (Reference 4), prepared from aerial photographs taken in 1982 (Reference 5).

Roughness coefficients (Manning's "n" values) for water-surface profile computations were determined from field inspection of stream channels and overbank areas and adjusted based upon engineering judgment. Roughness values ranged from 0.013 to 0.050 for the two main channels and from 0.05 to 0.1 for overbank areas.

Water-surface profiles were developed using HEC-2 step-backwater computer model (Reference 6). Profiles were determined for the 100-year flood for City Creek and for South Creek. Starting water-surface elevations were determined by normal depth calculations. As the result of the HEC-2 analyses, flows along City Creek, Manti Creek, and portions of South Creek were found to be contained within the narrow channels. Therefore, profiles have not been presented.

The diversion structure at the division of City Creek and South Creek limits the flow in City Creek to less than the channel capacity by directing excess flow into the South Creek channel. The newly constructed South Creek channel from the western city limits to Main Street has the capacity to carry the 100-year flood. The bridges from Main Street east to the junction of City Creek restrict the channel capacity and flood waters leave the channel to run over land. A potential for shallow flooding exists over a large area along South Creek with the extent of the flooding and the depth of flow depending on where the waters leave the channel.

Flood boundaries and shallow flooding depths were determined using normal depth calculations, field surveys, and a comparison with historical flooding.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 2).

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4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community.

The shallow flooding boundaries have been determined using the methods described in Section 3.2. The boundaries of the 100-year floods have been delineated using topographic maps at a scale of 1:4800, with contour intervals of 4 feet (Reference 4).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 1). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AO). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The concept of a floodway is not applicable for shallow flooding, so a floodway is not shown in the shallow flooding areas along South Creek. No floodways were computed for Manti Creek, City

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Creek, and South Creek where 100-year floods were determined to be contained within the channel. However, the stream channels must be kept free from encroachments to avoid increases in the 100-year floods.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplains.

7.0 OTHER STUDIES

In 1975, the USFS conducted a flood frequency analysis for Manti Creek (Reference 7). The peak discharge estimates obtained in this study were within the range obtained by the Forest Service.

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In 1980, Schick International, Inc. estimated the 100-year peak discharge for Manti Creek to be 4000 cfs (Reference 8). The flow was based on SCS curve number computations developed through comparison to Cottonwood Creek near Richfield, Utah watershed (an ungaged stream). Given current watershed conditions, it is considered unreasonable to expect a 100-year flood of 4000 cfs. Since the results of this study are based upon analysis of the actual gage records of the stream and others in the region, the peak discharges presented herein are considered more reliable.

The USGS in 1983 computed the flood frequency curve for Manti Creek at the stream gage as a part of the development of their most recent regional method for computing flood flow frequency (Reference 3). The USGS anaylsis is based on 12 years of record, whereas the results presented herein are based on 16 years of record with supplemental historical discharge estimates. The flows in this study are somewhat higher, but because of the longer record are considered to be more reliable.

Because of the more detailed analysis performed, this flood insurance study supersedes the previously published Flood Hazard Boundary Maps for the City of Manti, Utah (Reference 9) and the Flood Insurance Rate Map for the unincorporated areas of Sanpete County for flooding adjacent to Manti (Reference 10).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

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EXHIBIT 2 - ELEVATION REFERENCE MARKS
CITY OF MANTI, SANPETE COUNTY, UTAH

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	5531.66	Set by Thurgood and Associates. Railroad spike set in telephone pole at 800 North Street and 500 West Street.
RM 2	5567.56	Rollins, Brown, and Gunnell, Inc., temporary bench mark, southeast corner of wingwall on concrete flood channel at 600 West Street and 200 North Street.
RM 3	5584.91	Rollins, Brown, and Gunnell, Inc., temporary bench mark, "X" etched in south end of concrete wall just north of bridge at 300 North Street.
RM 4	5641.22	Rollins, Brown, and Gunnell, Inc., temporary bench mark, northeast corner of concrete pad of orange vacuum cleaner at Union Street.
RM 5	5807.97	Rollins, Brown, and Gunnell, Inc., temporary bench mark, "X" etched in northwest corner of north wall of City Creek main diversion headgate.

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